(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 243 210 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.09.2002 Bulletin 2002/39

(51) Int Cl.[7]: **A47J 31/40**, B65D 81/00

(21) Application number: **01107306.1**

(22) Date of filing: **23.03.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

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(54) Capsule and method for preparation of hot beverage and apparatus adapted for preparing a beverage from such a capsule

(57) The invention relates to a capsule (10) for the preparation of a beverage obtained by supplying hot water within the capsule under pressure and releasing the beverage from the capsule; said capsule comprising a food substance therein, a first surface (12) adapted to be traversed by a flow of water entering the capsule, a second surface (17) adapted to be traversed by a flow of beverage existing the capsule, wherein the second surface (17) is adapted to deform outwardly upon action of the inside water pressure thereon and wherein said surface (17) comprises at least one opening member (20) capable of deforming inwards the capsule (10) upon a mechanical reaction force applied from outside onto the opening member (20) as a result of the deformation of said second surface (17) due to the build-up of the inside presssure.

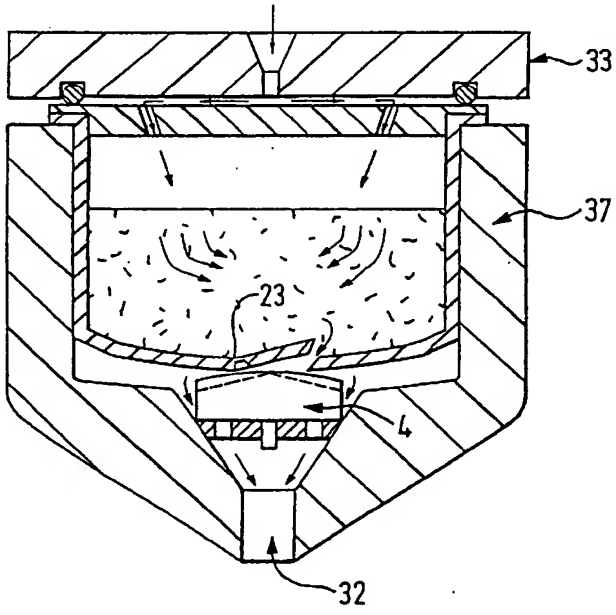

FIG. 6

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Description

[0001] The present invention relates to the preparation of a beverage from a capsule containing a dry food substance. More particularly, the invention relates to a capsule adapted for the preparation of a foamy beverage using hot water under pressure passing through the capsule. The invention also relates to a method for the preparation of a foamy beverage using such a capsule. The invention also relates to a beverage preparation device adapted to receive such a capsule for preparing a foamy beverage.

[0002] Foamed beverages such as espresso, cappuccino and latte prepared from a single serve capsule are becoming more and more popular. The principle of using pre-metered and pre-packed portions of coffee or the like for the preparation of coffee or other beverages has already existed for a long time. It has the advantage that it facilitates the preparation of coffee while ensuring that the quality of the product remains relatively consistent. It also provides more convenience for the operator. The capsule usually sits in a leak-tight enclosure of a coffee-type machine and hot water is passed through the capsule under pressure. The use of roast-and-ground powder is widely utilized commercially in capsules that perforate under the build-up of pressure to release the extracted liquid. However, to date, there do not exist any systems of capsules adapted for soluble powder that would confer a sufficient level of quality and foam able to compete with the roast-and-ground segment on the market. Therefore, all the attempts for such soluble powder containing capsules have not met with commercial success to date.

[0003] A critical problem commonly met with the existing capsules comes from the fact that the pressure cannot build up sufficiently well to have the powder entirely and homogeneously mixed with water. Channeling problems are usually noticed within the powder cake causing privileged paths for water and zones which are not properly wetted by water. Therefore, the capsule can usually not be fully emptied or washed causing inconsistent dosage and powder waste left within the capsule. Other common problems met with the existing capsules relate to the generation of a poor foam or even no foam at all thereby producing beverages such as cappuccino or latte of very poor quality. As a result, these poor quality beverages get very little consumer acceptance.

[0004] Those problems are dependent upon the way the pressure builds up inside the capsule and the way the beverage is released into the cup. The building-up of the pressure and release are critical steps to ensure a product of satisfactory quality as well as to ensure a correct emptying or washing of the product inside the capsule.

[0005] Another problem results from the intensive mechanical interactions between the capsule and the means that exert pressure onto the capsule to effect the release of the beverage. Usually, the capsule is perforated by perforated means such as a corrugated or cutting surface or an opening element forcing a passage through the bottom of the capsule and positioning within the capsule. Such interactions have a tendency to generate bits of material from the capsule, such as plastic bits and the like, which may contaminate the beverage.

[0006] The present invention has the object to provide a new type of capsule, which enables inside pressure building-up at a level required for a proper powder reconstitution or dissolution when producing the beverage. Another object of the invention is to provide a capsule capable of providing a beverage having an improved quality of foam resulting from the control of the release of the pressure built in the capsule before dispensing the beverage into the cup. Another object is to provide a capsule that reduces the severe mechanical interactions during the opening of the capsule for dispensing of the beverage thereby reducing the risks of producing bits of material such as small plastic pieces which could inadvertently mix with the beverage into the cup.

[0007] For this, the invention relates to a capsule for the preparation of a beverage obtained by supplying hot water within the capsule under pressure and releasing the beverage from the capsule; said capsule comprising a food substance therein, a first surface adapted to be traversed by a flow of water entering the capsule, a second surface adapted to be traversed by a flow of beverage exiting the capsule, wherein the second surface is adapted to deform outwardly upon action of the inside water pressure thereon and wherein said surface comprises at least one opening member capable of deforming inwards the capsule upon a mechanical reaction force applied from outside onto the closure member as a result of the deformation of the second surface due to the build-up of inside pressure deforming said second surface.

[0008] As a result of this, both the build-up of pressure inside the capsule and the release can be better controlled thereby providing an improvement of the quality of the beverage; i.e., a full powder reconstitution/dissolution with no waste inside and generation of good looking foam upon release of the pressure.

[0009] Preferably, the opening member comprises a continuous precut line cutting through the thickness of the second surface and further comprises a resilient folding means whereby the folding means is adapted to cause the opening member to fold upon action of said reaction force applied from outside onto the closure means to effect release of the beverage. The folding means may preferably be a single foldable portion arranged so that the opening member is capable of moving inwardly with respect to the rest of the second surface by folding along the foldable portion. Therefore, in addition to the advantages previously mentioned, such configuration induces less mechanical interactions as there is neither puncturing not cutting on the capsule. As a result, there are no risks of having bits of material

from the capsule contaminating the beverage at the time the beverage is dispensed through the outlet to the cup.

[0010] In a preferred embodiment, the precut line is arranged so that the opening member forms a valve means that closes upon the build-up of pressure caused by the addition of water inside the capsule till at least a certain pressure level. The valve configuration reinforces the strength of the opening member to the building-up of the inside pressure build-up thereby allowing a sufficient level of pressure to install within the capsule and consequently delaying the release of the beverage. Therefore, it is made possible to control to an appropriate level of pressure inside the capsule which is necessary for reconstituting, such as preferably by dissolution, the beverage before the beverage is released. As preferred embodiments, the precut line may be beveled or, alternatively, be stepped. In a more general manner, the valve means comprises at least one positive edge of the opening member that is capable of holding on a complementarily shaped edge of the opening as a response to the inside pressure thereby causing the closure of the opening member.

[0011] In a preferred embodiment, the foldable portion is of a transversal dimension lower than the peripheral dimension of the precut line. Therefore, the folding of the opening member is facilitated while lowering the risks of rupture or breakage of small bits of capsules.

[0012] Still preferably, the precut line has a width of from 0.05 to 0.3 mm, preferably of from 0.1 to 0.2 mm. Such dimension is suitable for providing a sufficient build-up of the inside pressure while allowing the capsule to deform outwardly until a reaction force can act to release the pressure for providing a high quality and foamy beverage. As defined, the width is also determined with respect to the usual powder size suitable for a proper beverage reconstitution so that no significant amount of powder can inadvertently exit the capsule when the capsule is stored before use.

[0013] In another aspect, the invention relates to a method for preparing a hot beverage using a capsule as previously mentioned comprising the step of providing such capsule, providing hot water entering the first surface and mixing the food substance with the water and build-up a pressure inside the capsule to prepare a beverage; providing means for generating a reaction force from outside of the capsule and opening the second surface by applying said reaction force onto the opening member as a result of the building-up of inside pressure deforming said second surface.

[0014] Preferably, the reaction force generating means and opening member are distant a certain gap before the pressure builds up in the capsule. The gap is determined to take into account the level of pressure desired inside the capsule that translates into a deformation of the capsule; i.e., of the second surface, which closes the gap and effect opening of the capsule. Therefore, the opening member is adapted to interact with the capsule until a certain inside pressure has been created within the capsule thereby ensuring a controlled building-up of the inside pressure and a delaying of the release of pressure at the required level for improving the dissolution and the quality of foam of the resulting product. In such configuration, the capsule comprises valve means as previously defined so as to resist to the increase of the inside pressure caused by the water entering the capsule.

[0015] More preferably, the opening of the capsule may be effected by build-up of pressure inside the capsule at a level sufficient to cause the second surface to deform outwards and the opening member becomes contacted by the reaction force generating means thereby causing the opening means to resiliently deform inwardly and consequently effecting the release of the beverage. The opening of the capsule may thus be effected automatically in a very precise and reproducible manner as the capsule "inflates" until the opening of the capsule is actuated by the reaction force generating means. Therefore, the reaction force generating means may preferably be distant a certain predetermined gap from the opening member and be positioned in a fixed position with respect to opening member; such predetermined gap corresponding to the required level of pressure deemed necessary for the intended beverage.

[0016] In another aspect the invention relates to an apparatus for preparing a beverage adapted to receive a capsule as defined previously, said apparatus comprising:

(i) a housing arranged for lodging the capsule in a substantially fixed position whereas allowing at least the second surface to deform outwardly upon the action of inside pressure build-up and,

(ii) a reaction force generating means adapted to hold on the opening member and to cause the opening member to move inwardly so as to effect release of the beverage as a result of the pressurization of the capsule with water.

[0017] Preferably, the reaction force generating means comprises a pressure surface adapted to hold on the opening member of the capsule as a response of the increase of inside pressure; said surface being larger than the opening member so as to effect the opening according to a limited range of angulation possible. This allows a release of relatively high pressure suitable for the formation of a nice looking foam. This also allows for a gentler opening of the capsule with lower mechanical stress and consequently reduced risks of contamination by loose bits from the capsule. More preferably, the pressure surface is bulged to limit the size of the opening of the capsule. Such limitation of the size of the opening permits to better control the pressure release for a better foam but also reduces the stress on the opening member.

[0018] The release of the beverage may also be better

ensured if one provides channels extending along or through the pressure surface of the reaction force generating means thereby guiding the foam and liquid toward the dispensing outlet. The size and shape of those channels can be optimized to improve the generation of foam, as well, as to regulate the evacuation of liquid flow.

[0019] Specific embodiments of the present invention will now be described with reference to the drawings of which:

Fig. 1 is a perspective view of a capsule according to the invention;

Fig. 2 is a cross sectional view along line A-A of the capsule of Fig. 1;

Fig. 3 Is a bottom view of the capsule of Fig. 1 and 2;

Fig. 3A shows a detail along line B-B of Fig. 3;

Fig. 3B shows a variant of Fig. 3A;

Fig. 4 illustrates a cross sectional diagrammatic view of the capsule as positioned at rest within the housing of the beverage preparation unit;

Fig. 4A illustrates a detail of the plunger of Fig. 4;

Fig. 4B illustrates a variant of Fig. 4A;

Fig. 5 is a view similar to Fig. 4 but with water being introduced within the capsule and inside pressure starting to build up;

Fig. 6 is a view similar to Fig. 4 and 5 but with the inside pressure at a level which causes the opening of the capsule and release of the beverage;

Fig. 7 is a view of detail of Fig. 5;

Fig. 8 is a view of detail Fig. 6;

Fig. 8A is a top view of the plunger showing the line of demarcation of the opening when fitting on the pressure surface of the plunger;

Fig. 9 is an embodiment of the opening means of the beverage preparation unit;

Fig. 10 is a top view of the opening means of Fig. 9;

Fig. 11 is another embodiment of the opening means;

Fig. 12 is a cross sectional view of the capsule as positioned at rest within the housing of the beverage preparation unit according to another embodiment of the invention.

[0020] Referring to Fig. 1 to 3 and 3A, the invention illustrates a capsule 10 adapted to contain a dry food substance, preferably a substance that is soluble by addition of a diluent such as hot water and the like to form a foamy beverage. As "foamy beverage" it is meant a beverage such as coffee, cappuccino, latte, tea, milk, cream-based beverage, cocoa, stock and a combination thereof. The capsule 10 may preferably comprise a cup-shaped body 11 and a coverlid 12. The lid forms the first surface of the capsule intended for the water to enter therethrough. The lid 12 may be attached to the body along a common peripheral edge 13 and sealed to the body by any suitable means such as by welding, adhesive or hot melt sealing and/or mechanical connection. The lid 12 may be provided with two small and diametrically opposed holes 14, 15 thereby leading to an internal cavity 16 contalning the food substance. At the opposite side, a bottom side 17 Is provided which forms a second surface of the capsule intended for the exit of the liquid beverage. The water is supposed to enter the first surface or lid 12 through the holes, create solubilization of the food substance and then, exit through the second surface or bottom side 17 as it will be explained in greater details later on. In an alternative, the two holes may be omitted and the lid of the capsule may be punctured at the time the beverage is prepared in the unit as it is also well known in the art.

[0021] The body 11 of the capsule is preferably constituted of a pressure resistant but elastically deformable material such as a thin, semi-rigid plastic material. More particularly, the second surface or bottom side 17 of the capsule should be able to withstand an inside pressure of several bars ; i. e., 1.5 to 15 bars, preferable 2-6 bars, while being capable of expanding outwardly as a response to such building-up of pressure. For that, the capsule may be made of plastic such as PP and PE or any other suitable foodgrade and heat and pressure resistant polymer material having a thickness of between 0.25 to 2 mm. As illustrated in Fig. 2 to 3A, the bottom side comprises an opening member 20. The opening member includes a continuous precut line 21 which traverses the thickness "t" of the bottom side. The precut line 21 is preferably a portion of circle although its geometry is not limiting but may also encompass a large choice of other possible shapes. Folding means 22 is further provided which is arranged with the precut line so that the opening member is capable of folding inwardly along a privileged folding line. For that, the folding means may preferably be a single foldable portion 23 located between both ends of the precut line 21. The foldable portion is preferably non-recovering in the sense that when submitted to a flexure, the opening member does not recover its initial position of before the flexure. This important aspect ensures that when the pressure in the capsule starts decreasing due to the release effect, the opening remains open and the beverage can be fully dispensed.

[0022] In the preferred embodiment as shown, the

opening member forms a valve means which is arranged so that it can withstand a certain inside pressure while substantially closing and, conversely can open inwards as a response to an outside reaction force applied thereon. For that, the precut line 21 is beveled with the outer peripheral edge 24 of the opening member being capable of holding on a complementary edge 25 of the bottom side when a pressure from inside builds up due to water under pressure entering the capsule. Therefore, the precut line is configured so that the section of the opening member gradually decreases outwards. In order to facilitate the inwardly oriented folding of the opening member, a line of weakness 26 may further be provided that promotes bending of the opening member along the privileged line. Such line of weakness may, for instance, be a short outer groove or any suitable equivalent means.

[0023] The embodiment of the capsule as shown in Fig. 1 to 3 and 3A is the preferred mode although other variants may provide equivalent results. Its has been determined that the precut line should preferably extend along a portion significant enough to be easily bent while limiting the risks of rupturing the plastic material. Preferably, the portion of the precut line should extend along an angular path of from 270 to 350 degrees, preferably 290 to 300 degrees. Similarly, the width of the precut line may be a determining factor that influences the building-up of inside pressure while it also ensures no significant amount of powder can escape from the capsule in the stored conditions. Therefore, it has been determined that the width of the precut line should preferably range from 0.05 to 0.3 mm, preferably from 0.1 to 0.2 mm.

[0024] Fig. 3B illustrates a possible variant for the opening member in a configuration wherein it still acts as a valve means having the ability to withstand a certain inside pressure level and conversely, opens under the effect of the outside reaction force. In this configuration, the precut line is shaped to form a stepped configuration with the peripheral edge 24 of the opening member being complementary shaped to be able to hold on the outer edge 25 of the opening of the bottom side as a result of a certain increase of pressure inside the capsule.

[0025] Fig. 4A illustrates the capsule of fig. 1 to 3A when lodged in position within a beverage preparation unit 3. The unit comprises a main housing 30 of a size adapted to receive the body of the capsule while the upper edge 13 of the body is retained along a complementary peripheral shoulder 31 of the housing. In the bottom part of the housing 30 is provided a beverage outlet 32 for the release of the beverage toward a dispensing area (not shown).

[0026] According to an important aspect of the invention, the beverage preparation unit comprises a means 4 for providing a mechanical reaction force to the opening member 20 of the capsule as a response to the deformation of the capsule; i.e., the outward or downward expansion of the second surface, due to the building-up of inside pressure during the water filling of the capsule. For that, the reaction force generating means 4 consists of a plunger 40 vertically aligned with the opening member 20 and the outlet 32. The plunger 40 is fixed in position on an apertured support 47 that leaves the outlet substantially open. More precisely, the plunger 40 includes a pressure surface 41 adapted to hold on the opening member 20. The pressure surface is arranged so that it has a surface larger than the surface of the opening member. The pressure surface also has a non-aggressive shape not to cause puncturing or piercing of the capsule but, on the contrary, to effect opening of the opening member 20 by gently moving the member inwards along an opening path of limited angulation along the folding portion of the member. For that, it is preferred to have a pressure surface that is bulged.

[0027] FIG. 4 illustrates a first embodiment of the plunger wherein the pressure surface is a single bulged portion of radius R. Suitable bulge radius R may preferably be of from about 40 to 80 mm. In order to release the pressure in a controlled manner, channels 42 are provided at the surface of the plunger which extend from the area intended to be covered by the opening when the plunger contacts the opening member. The channels preferably extend radially so as to distribute uniformly the foam and then, the liquid within the outlet. The channels are important since they determine the flow velocity and produces turbulences that creates the foam. Other configurations of channels could also possibly be proposed such as several channels which traverse through the plunger. Fig. 4B illustrates a second possible embodiment wherein the pressure surface is composed of a first main bulged portion of radius R_1 intersected in the center by a second smaller circular portion of radius R_2; with R_2 being smaller than R_1. As a preferred example, R_1 ranges from 40 to 80 mm and R_2 ranges from 20 to 40 mm.

[0028] As shown in Fig. 4 and 7, when in at rest position; i.e., before the water pressurization, the housing of the unit is dimensioned so that the capsule, more specifically the opening member 20 of the capsule, is kept distant the pressure surface 41 a certain gap "d" necessary to generate a desired increase of pressure inside the capsule as the valve means of the opening member is sufficient to withstand that amount of pressure.

[0029] The preparation cycle is demonstrated in accordance with Fig. 4 to 8. In a first stage, the capsule is positioned in the housing of a first unit part 37 and locked in position by means of an upper part 33 of the unit. The upper unit part 33 comprises a water distribution chamber 34, a water inlet 36 and a watertightness means 35 adapted to render the chamber watertight upon closing. The lower unit part 37 and the upper unit part 33 engage together in closure by any suitable driving means such as an hydraulically driven assembly (not shown). In a closed configuration of the housing, the plunger 40 is positioned at a distance from the capsule and there is a small predetermined gap "d" between the capsule open-

ing member and the pressure surface (Fig. 4). The gap is determined as a function of the intended pressure to build inside the capsule. Repeated tests have shown that it should preferably be of from 0 to 5 mm, preferably 0.1 to 3 mm.

[0030] As shown by Fig.5, pressurized hot water enters the capsule through the two small holes 14, 15 of the lid and mix with the powder inside the capsule. As more water enters the capsule, the inside pressure starts building up so causing the body of the capsule, and more particularly, its bottom side, to deform outwardly. As the bottom deforms, the distance between the plunger and the capsule starts lessening until the opening member 20 of the capsule comes into abutting contact with the pressure surface 41 of the plunger as shown in Fig. 5. The capsule keeps deforming outwards till the pressure surface of the plunger starts applying a reaction force to the inside pressure. Such reaction force as gradually increasing acts on the opening member which flexes along its folding portion 23 (Fig. 6 and 8). As shown by Fig. 8 and 8A, in its periphery, the bulged surface 40 is adapted to substantially fit the peripheral contour or demarcation line 26 of the opening as the surface of the capsule deforms outwards while pushing the opening member in the center of the surface. As the opening member moves inwards, the liquid mixture which has reached a desired pressure inside is released through the radial channels 42 provided on the pressure surface. The pressure that releases after exiting the channels generates foams and the pressure inside the capsule stabilized (Fig. 6). At the end of the dispensing, the water stops entering the capsule and the plunger separates from the capsule as the capsule substantially or partially recovers its initial dimension due to the release of inside pressure. As the opening member has the ability to remain open, the beverage remaining inside the capsule can be fully discharged to the outlet.

[0031] Fig. 9 and 10 illustrate a variant of the reaction force generating means or plunger 4. In this variant, the pressure surface comprises a solid central part 43 surrounded by an outer resilient part 44. The solid central part may be a metal or solid plastic piece forming a rod extending from a support base 45 of the plunger. The outer part 44 may be a rubber or soft plastic annular piece that is capable of compressing when contacting the opening member of the capsule. The compressibility of the outer part 44 may be particularly important depending upon the particular geometry and configuration of the capsule to reduce the risks of damaging the capsule.

[0032] Fig. 11 refers to another variant of the plunger which differs from the previous version by the fact the outer part remains a solid piece but is spring biased using a spring element 46 located between the outer part 44 and the supportive base 45.

[0033] Fig. 12 is another possible embodiment of the invention wherein the reaction force generating means 4 is positioned to hold the capsule 10 before the capsule is even pressurized with water. In that particular case, the opening member 20 may not necessarily be a valve means but may require the support of the reaction force generating means to prevent opening before a sufficient pressure level is achieved inside the capsule. More particularly, the opening member 20 of the capsule may include a precut line that is not beveled or stepped but simply cut normal to the bottom surface of the capsule so that the pressure surface forces the opening member to open.

[0034] In the foregoing description, the reference to the term "capsule" has been made for designating any sort of containers suitable for the intended purpose. Therefore, this term "capsule" should not be construed in a restricted way. Similarly, the term "plunger" has been designated in place of the term "reaction force generating means" for facilitating the comprehension and should also not be construed in a limitative way but may encompass various designs and/or configurations suitable for the intended purpose. The terms "inwards" or "inwardly", "outwards" or "outwardly" or "downwards" or "downwardly" have been used in reference to the capsule when in operation in the beverage preparation apparatus; more particularly, to designate the direction of deformation of the second surface or bottom side of the capsule and its opening member.

[0035] The invention described and claimed herein is not strictly limited in scope by the specific embodiments herein disclosed, since these embodiments are intended as illustration of several aspects of the invention. Any equivalent embodiments are intended to be within the scope of this invention. Indeed, various modifications of the invention will become apparent those skilled in the art from the foregoing description. Such modifications are also intended to fall within the scope of the appended claims.

Claims

1. Capsule for the preparation of a beverage obtained by supplying hot water within the capsule under pressure and releasing the beverage from the capsule; said capsule comprising a food substance therein, a first surface adapted to be traversed by a flow of water entering the capsule, a second surface adapted to be traversed by a flow of beverage exiting the capsule, wherein the second surface is adapted to deform outwardly upon action of the inside water pressure thereon and wherein said surface comprises at least one opening member capable of deforming inwards the capsule upon a mechanical reaction force applied from outside onto the closure member as a result of the deformation of said second surface due to the build-up of inside pressure.

2. Capsule according to claim 1, wherein the opening

member comprises a continuous precut line cutting through the thickness of the second surface and wherein the opening member comprises a resilient folding means which is adapted to cause the opening member to fold upon action of said reaction force applied from outside onto the closure means to effect release of the beverage.

3. Capsule according to claim 2, wherein the resilient folding means comprises a single foldable portion arranged with respect to said precut line so that the opening member is capable of moving inwardly by folding along said foldable portion.

4. Capsule according to claim 2 or 3, wherein the precut line is arranged so that the opening member forms a valve means that is capable of closing upon the build-up of pressure caused by the addition of water inside the capsule till at least a certain pressure level.

5. Capsule according to claim 4, wherein the precut line forms a valve means with a positive edge of the opening member holding on a complementarily shaped edge of the opening upon the build-up of pressure inside the capsule.

6. Capsule according to claim 5, wherein the precut line is beveled.

7. Capsule according to claim 5, wherein the precut line is stepped.

8. Capsule according to claim 2 or 3, wherein the foldable portion is of a transversal dimension lower than the peripheral dimension of the precut line.

9. Capsule according to claim 8, wherein the foldable portion further comprises a line of weakness promoting bending of the opening member along a privileged line.

10. Capsule according to any of claims 2 to 9, wherein the precut line has a width of from 0.05 to 0.3 mm, preferably of from 0.1 to 0.2 mm.

11. Capsule according to any of claims 2 to 10, wherein the opening member is demarcated by the precut line so as to substantially form a portion of circle.

12. Capsule according to any of claims 2 to 11, wherein the portion of circle is of from 270 to 350 degrees.

13. Capsule according to claim 12, wherein the portion of circle has a diameter of from 3 to 15 mm.

14. Capsule according to any of the preceding claims, wherein the food substance is a soluble food product.

15. Capsule according to any of the preceding claims, wherein the soluble food product is selected among the group consisting of coffee, tea, cocoa, milk, and combinations thereof.

16. Method for preparing a foamy hot beverage comprising :

providing a capsule comprising a food substance therein, a first surface adapted to be traversed by a flow of water entering the capsule, a second surface adapted to be traversed by a flow of beverage exiting the capsule, wherein said surface comprises at least one opening member capable of creating an opening upon actuation from a mechanical reaction force applied from outside onto the opening member to effect release of the beverage;

providing hot water entering the first surface and mixing the food substance with the water and build-up a pressure inside the capsule to prepare a beverage;

providing means for generating a reaction force from outside of the capsule and,

opening the second surface by applying said mechanical reaction force onto the opening member as a result of the build-up of inside pressure deforming said second surface.

17. Method according to claim 16, wherein the opening member and the reaction force generating means are kept distant a certain predetermined gap before the required pressure builds up in the capsule

18. Method according to claim 17, wherein said gap is of from 0 to 5 mm, preferably 0.1 to 3 mm.

19. Method according to claim 17 or 18, wherein opening of the opening member is effected by build-up pressure inside the capsule sufficiently to cause the second surface to deform outwards and to be held on the reaction force generating means thereby causing the opening means to deform the opening means inwardly and to consequently effect release of pressure and dispense of the beverage.

20. Method according to any of claims 16 to 19, wherein the reaction force generating means is fixed in position with respect to the opening member.

21. Method according to any of claims 17 to 20, wherein the reaction force generating means comprises a pressure surface adapted to hold on the opening

member; said surface being larger than the opening member so as to effect the opening of the opening member without the surface fully entering within the capsule.

22. Method according to claim 21, wherein the pressure surface is a bulged surface, with the same or smaller radius of the center part.

23. Method according to claim 22, wherein the bulged pressure surface has a portion of radius of from about 40 to 80 mm.

24. Method according to claim 22 or 23, wherein the bulged pressure surface is solid.

25. Method according to claim 21, wherein the pressure surface comprises a solid central part and an outer resilient part surrounding the central part; said central part being of section lower than the opening member whereas the outer resilient part having a section higher than the opening member.

26. Method according to any of claims 21 to 25, wherein the pressure surface comprises at least one radially oriented channel for releasing the beverage along the pressure surface.

27. Device for preparing a foamy hot beverage adapted to receive a capsule comprising a food substance therein having a first and second surfaces adapted to be traversed by a flow of water and comprising at least one opening member capable of creating an opening upon action of a reaction force applied from outside of the capsule onto the opening member to effect release of the beverage, wherein said apparatus comprising:

(i) a housing arranged for lodging the capsule in a substantially fixed position whereas allowing at least the second surface to deform outwardly upon the action of inside pressure build-up and,

(ii) a reaction force generating means adapted to hold on the opening member and to cause the opening member to move inwardly so as to effect release of the beverage as a result of the pressurization of the capsule with water.

28. Device for preparing a foamy hot beverage according to claim 27, wherein said reaction force generating means comprises a pressure surface adapted to hold on the opening member in reaction of the inside pressure; said surface being larger than the opening member so as to effect the opening of the opening member according to a limited angulation.

29. Method according to claim 28, wherein the pressure surface is a bulged surface.

30. Method according to claim 28, wherein the pressure surface comprises a solid central part and an outer resilient part surrounding the central part; said central part being of section lower than the opening member whereas the outer resilient part having a section higher than the opening member.

31. Method according to any of claims 27 to 30, wherein the pressure surface is arranged at a certain predetermined gap from the opening member of the capsule before pressurization takes place so as to delay holding on the opening member and consequently opening until a sufficient pressure is built up in the capsule.

32. Method according to claim 27 to 31, wherein said reaction force generating means includes means for channelling the foam and liquid.

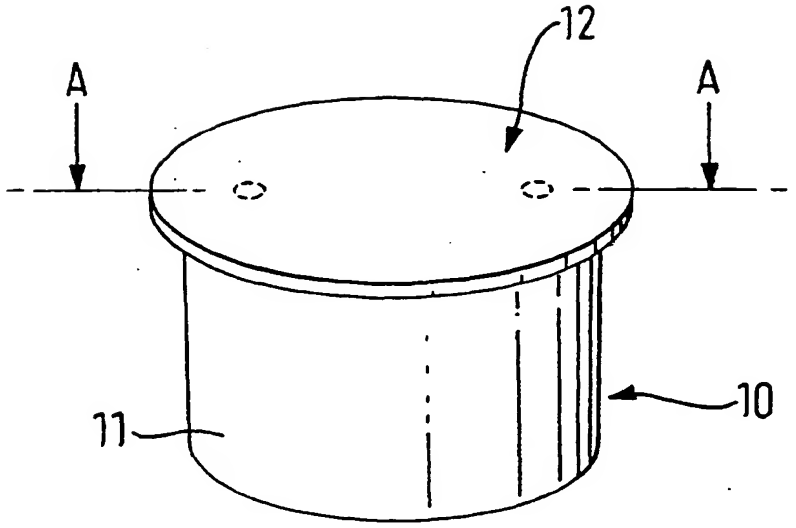

FIG. 1

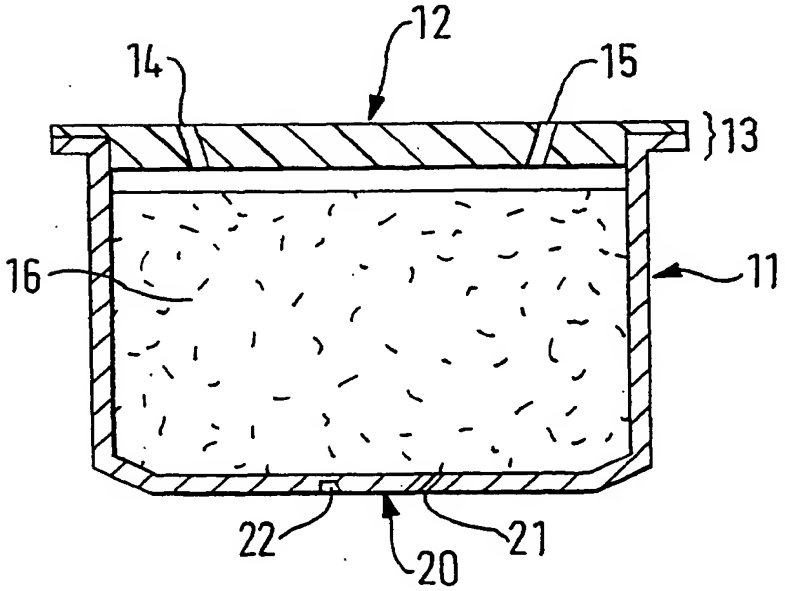

FIG. 2

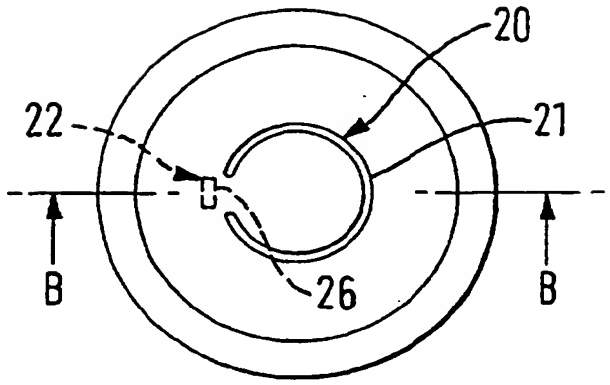

FIG. 3

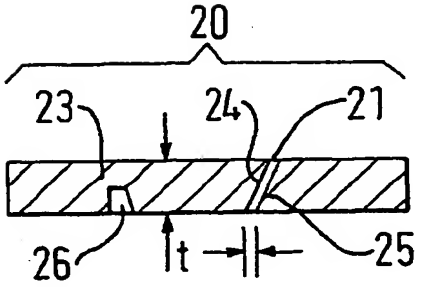

FIG. 3A

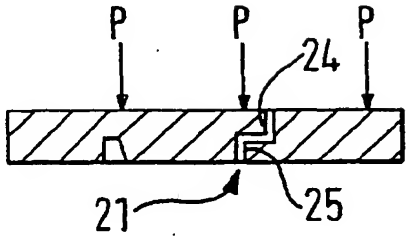

FIG. 3B

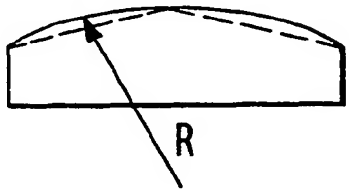

FIG. 4A

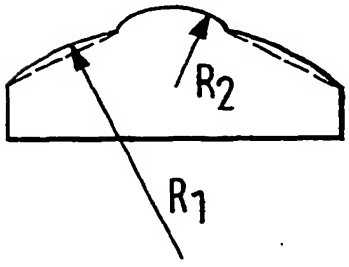

FIG. 4B

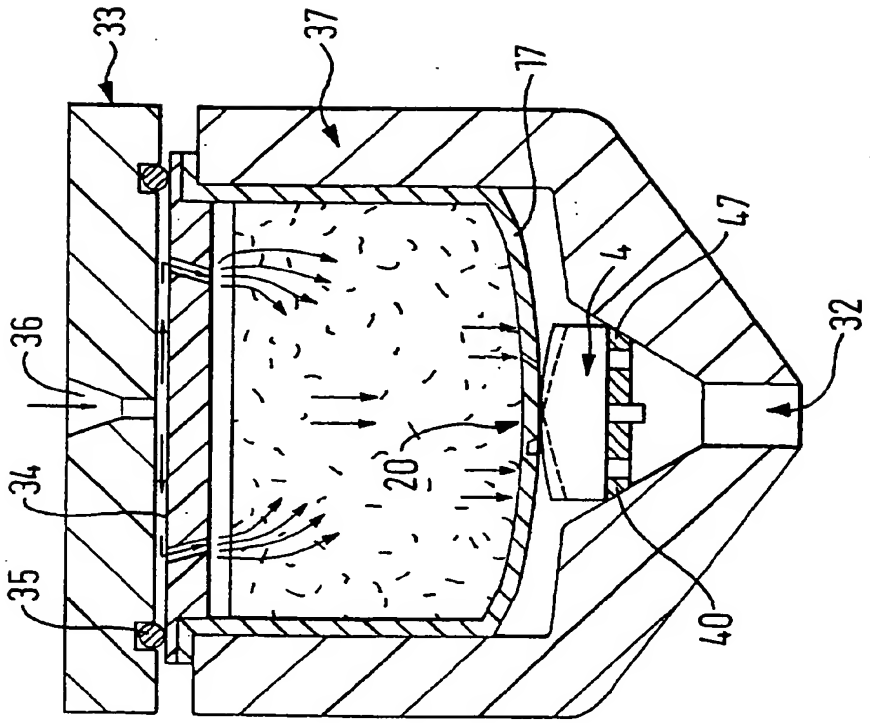

FIG. 5

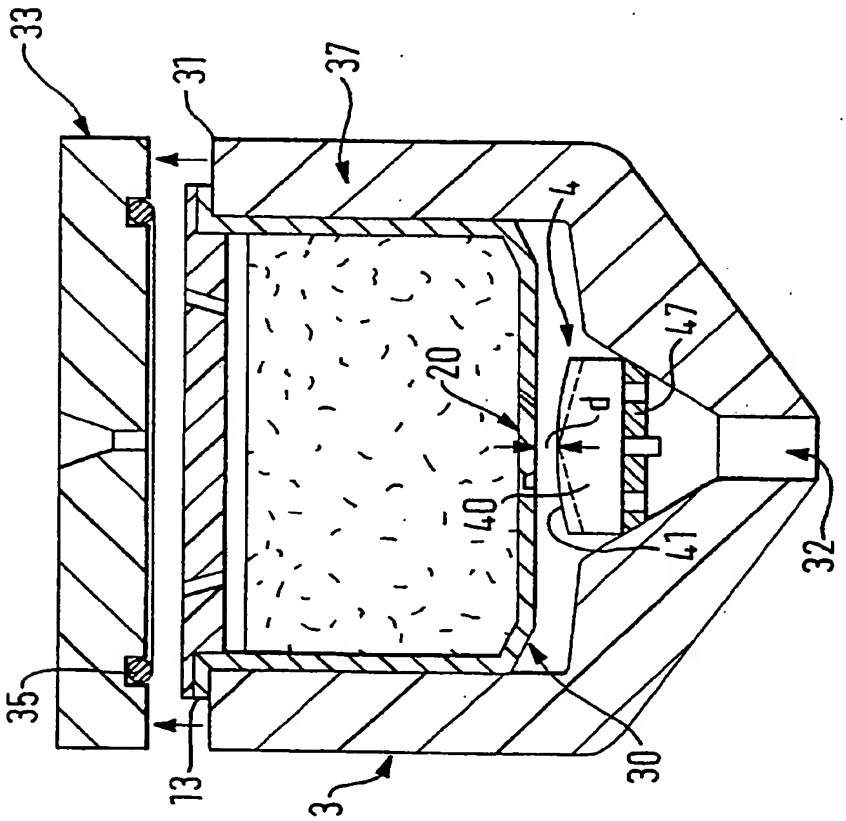

FIG. 4

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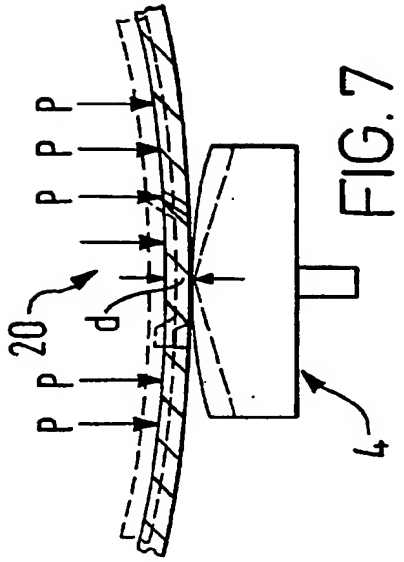

FIG. 7

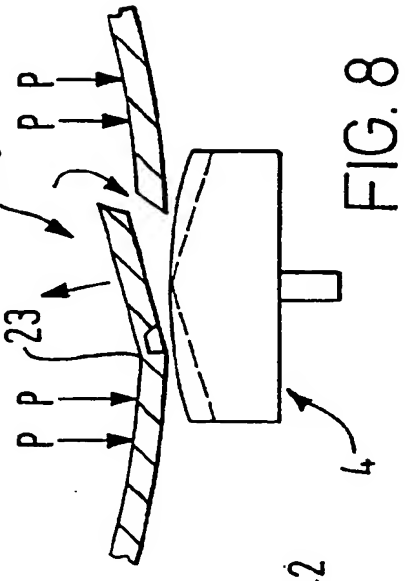

FIG. 8

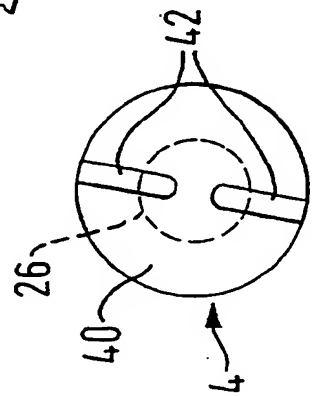

FIG. 8A

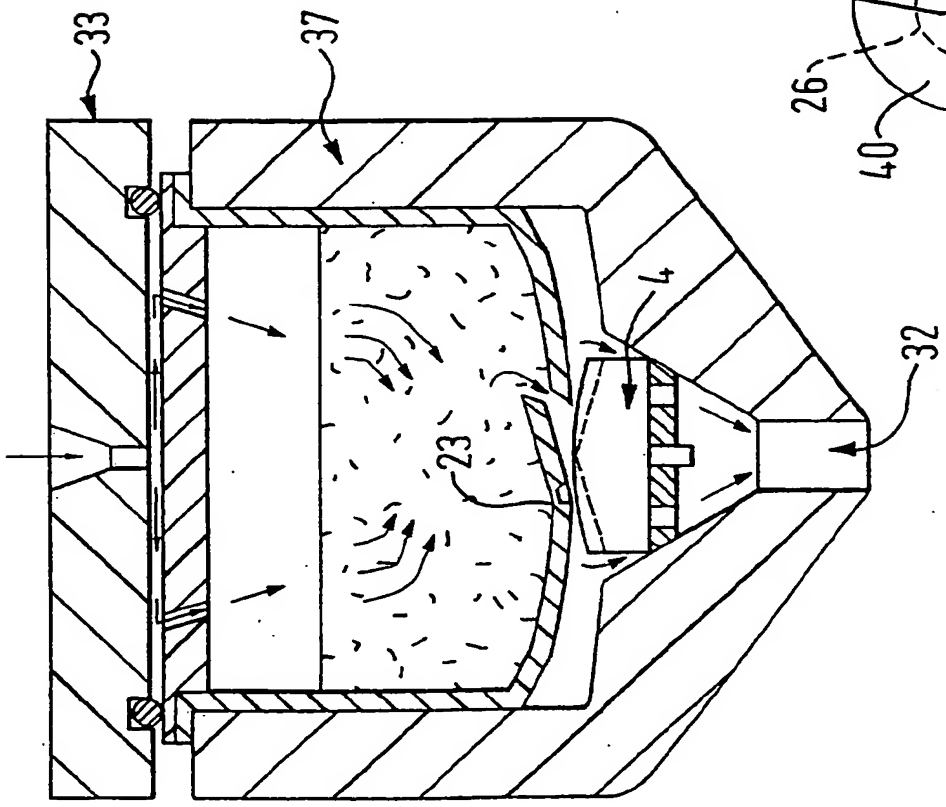

FIG. 6

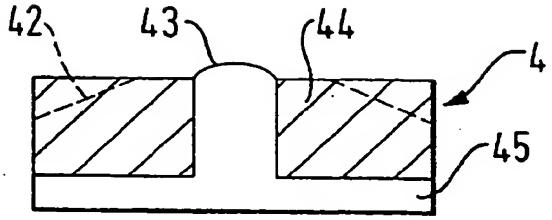

FIG. 9

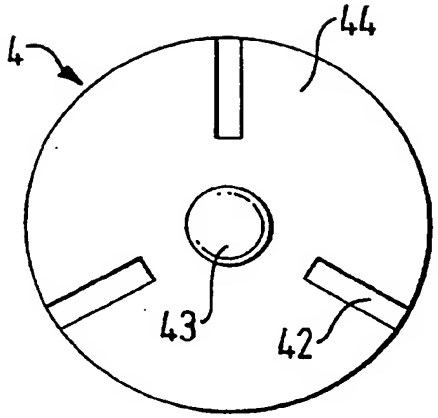

FIG.10

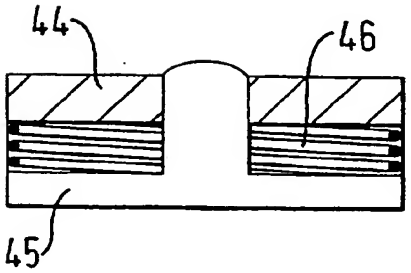

FIG. 11

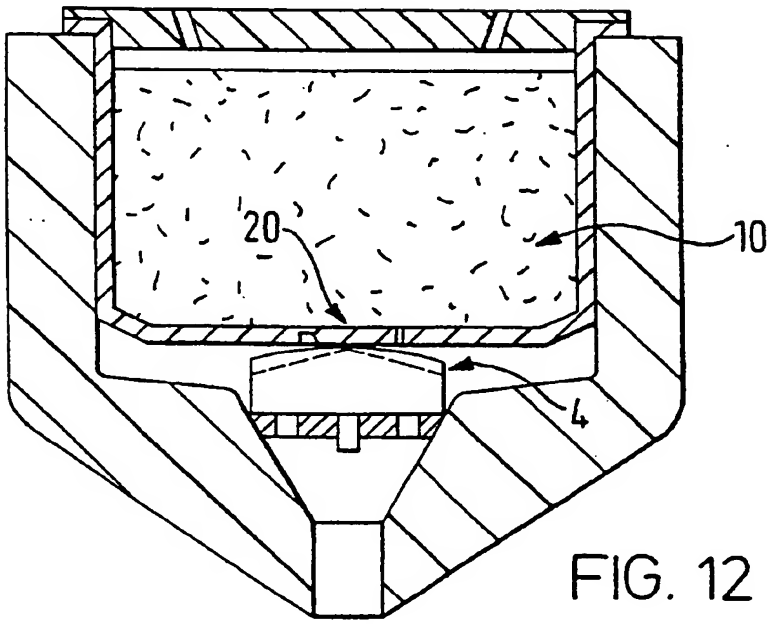

FIG. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 01 10 7306

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A47J
B65D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	10 August 2001	Novelli, B

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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